

SUBCHAPTER 8

LOW-RISE RESIDENTIAL BUILDINGS—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

SECTION 150.1 PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR LOW-RISE RESIDENTIAL BUILDINGS

(a) **Basic requirements.** Low-rise residential buildings shall meet all of the following:

1. The applicable requirements of Sections 110.0 through 110.10.
2. The applicable requirements of Section 150.0 (mandatory features).
3. Either the performance standards or the prescriptive standards set forth in this section for the climate zone in which the building is located. Climate zones are shown in Reference Joint Appendix JA2 –Weather/Climate Data.

Exception to Section 150.1(a)3: If a single contiguous subdivision or tract falls in more than one climate zone, all buildings in the subdivision or tract may be designed to meet the performance or prescriptive standards for the climate zone that contains 50 percent or more of the dwelling units.

Note: The Commission periodically updates, publishes, and makes available to interested persons and local enforcement agencies precise descriptions of the climate zones, which is available in Reference Joint Appendix JA2 –Weather/Climate Data.

Note: The requirements of Sections 150.0(a) through 150.0(r) apply to newly constructed buildings. Sections 150.2(a) and 150.2(b) specify which requirements of Sections 150.1(a) through 150.1(c) also apply to additions or alterations.

(b) **Performance standards.** A building complies with the performance standard if the energy budget calculated for the proposed design building under Subsection 2 is no greater than the energy budget calculated for the standard design building under Subsection 1.

1. **Energy budget for the *standard design building*.** The energy budget for a standard design building is determined by applying the mandatory and prescriptive requirements to the proposed design building. The energy budget is the sum of the TDV energy for space-conditioning, mechanical ventilation and water heating.
2. **Energy budget for the *proposed design building*.** The energy budget for a proposed design building is determined by calculating the TDV energy for the proposed design building. The energy budget is the sum of the TDV energy for space-conditioning, mechanical ventilation and water heating. The energy budget for the proposed design building is reduced if on-site renew-

able energy generation is installed, according to methods established by the Commission in the *Residential ACM Reference Manual*.

3. **Calculation of energy budget.** The TDV energy for both the standard design building and the proposed design building shall be computed by compliance software certified for this use by the Commission. The processes for compliance software approval are documented in the *Residential ACM Approval Manual*.
4. **Compliance demonstration requirements for performance standards.**

A. Certificate of compliance and application for a building permit. The application for a building permit shall include documentation pursuant to Sections 10-103(a)1 and 10-103(a)2 which demonstrates, using an approved calculation method, that the building has been designed so that its TDV energy use from depletable energy sources does not exceed the combined water-heating and space-conditioning energy budgets for the applicable climate zone.

Exception to Section 150.1(b)4A Multiple orientation: A permit applicant may demonstrate compliance with the energy budget requirements of Section 150.1(a) and (b) for any orientation of the same building model if the documentation demonstrates that the building model with its proposed designs and features would comply in each of the four cardinal orientations.

- B. Field verification of installed features, materials, components, manufactured devices and system performance shall be documented on applicable certificates of installation pursuant to Section 10-103(a)3, and applicable certificates of verification pursuant to Section 10-103(a)5, in accordance with the following requirements when applicable:
- i. SEER Rating. When performance compliance requires installation of space a conditioning system with a SEER rating that is greater than the minimum SEER rating required by Table 150.1-A, the installed system shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.4.4.1.
 - ii. EER Rating. When performance compliance requires installation of a space conditioning system that meets or exceeds a specified EER rating, the installed system shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.4.4.1.
 - iii. Low leakage air handler. When performance compliance requires installation of a low leakage

airhandling unit that meets the qualifications in Reference Joint Appendix JA9, the installed air-handling unit shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.1.4.3.9.

(c) **Prescriptive standards/component packages.** Buildings that comply with the prescriptive standards shall be designed, constructed and equipped to meet all of the requirements for the appropriate climate zone shown in Table 150.1-A. In Table 150.1-A, a NA (not allowed) means that feature is not permitted in a particular climate zone and a NR (no requirement) means that there is no prescriptive requirement for that feature in a particular climate zone. Installed components shall meet the following requirements:

1. **Insulation.**

A. Roof and ceiling insulation shall be installed in a ventilated attic with an *R*-value equal to or greater than that shown in Table 150.1-A meeting Options i through iii below.

- i. Option A: A minimum *R*-value of continuous insulation installed above the roof rafters in contact with the roof deck and an additional layer of ceiling insulation located between the attic and the conditioned space when meeting Section 150.1(c)9A; or
- ii. Option B: A minimum *R*-value of insulation installed between the roof rafters in contact with the roof deck and an additional layer of ceiling insulation located between the attic and the conditioned space when meeting Section 150.1(c)9A; or
- iii. Option C: A minimum *R*-value of ceiling insulation located between the attic and the conditioned space when meeting Section 150.1(c)9B.

Note: Low rise residential single family and multifamily buildings with the ducts and air handler located in the conditioned space, as specified by Section 150.1(c)9B, need only comply with insulation requirements of Option C.

B. Walls (including heated basements and crawl spaces) shall be insulated such that the opaque wall has an assembly *U*-factor equal to or less than shown in Table 150.1-A, or walls shall be insulated between wood framing with an *R*-value equal to or greater than shown in Table 150.1-A. The *U*-factors shown are maximum *U*-factors for the opaque wall assembly. Alternatively, for mass walls above grade and for below grade walls with insulation installed on the interior, the *R*-values shown are the minimum *R*-values for insulation installed between wood-framing members; and for below grade walls with exterior insulation, the *R*-values shown are the minimum *R*-values for continuous insulation.

C. Raised-floors shall be insulated such that the floor assembly has an assembly *U*-factor equal to or less than shown in Table 150.1-A, or shall be insulated

between wood framing with insulation having an *R*-value equal to or greater than that shown in Table 150.1-A.

Exception to Section 150.1(c)1C: Raised-floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in Table 150.1-A, and a vapor retarder is placed over the entire floor of the crawl space, and the vents are fitted with automatically operated louvers, and the requirements of Reference Residential Appendix RA 4.5.1 are met.

D. Slab floor perimeter insulation shall be installed with a *U*-factor equal to or less than, or *R*-value equal to or greater than, shown in Table 150.1-A. The minimum depth of concrete-slab floor perimeter insulation shall be 16 inches or the depth of the footing of the building, whichever is less.

Exception to Section 150.1(c)1: The insulation requirements of Table 150.1-A may also be met by ceiling, roof deck, wall, or floor assemblies that meet the required maximum *U*-factors using a *U*-factor calculation method that considers the thermal effects of all elements of the assembly and is approved by the executive director.

2. **Radiant barrier.** A radiant barrier required in Table 150.1-A, shall meet the requirements specified in Section 110.8(j), and shall meet the installation criteria specified in the Reference Residential Appendix RA4.

3. **Fenestration.**

A. Installed fenestration products shall have an area-weighted average *U*-factor and SHGC no greater than the applicable value in Table 150.1-A and shall be determined in accordance with Sections 110.6(a)2 and 110.6(a)3.

Exception 1 to Section 150.1(c)3A: For each dwelling unit, up to 3 square feet of new glazing area installed in doors and up to 3 square feet of new tubular skylights area with dual-pane diffusers shall not be required to meet the *U*-factor and SHGC requirements of Table 150.1-A.

Exception 2 to Section 150.1(c)3A: For each dwelling unit up to 16 square feet of new skylight area with a maximum *U*-factor of 0.55 and a maximum SHGC of 0.30.

Exception 3 to Section 150.1(c)3A: For fenestration containing chromogenic type glazing:

- i. the lower-rated labeled *U*-factor and SHGC shall be used with automatic controls to modulate the amount of solar gain and light transmitted into the space in multiple steps in response to daylight levels or solar intensity;
- ii. Chromogenic glazing shall be considered separately from other fenestration; and
- iii. area-weighted averaging with other fenestration that is not chromatic shall not be permitted and

shall be determined in accordance with Section 110.6(a).

Exception 4 to Section 150.1(c)3A: For dwelling units containing unrated site-built fenestration that meets the maximum area restriction, the *U*-factor and SHGC can be determined in accordance with the Nonresidential Reference Appendix NA6 or use default values in Table 116-A and Table 116-B.

- B. The maximum total fenestration area shall not exceed the percentage of conditioned floor area CFA as indicated in Table 150.1-A. Total fenestration includes skylights and west-facing glazing.
 - C. The maximum west-facing fenestration area shall not exceed the percentage of conditioned floor area as indicated in Table 150.1-A. West-facing fenestration area includes skylights tilted in any direction when the pitch is less than 1:12.
4. **Shading.** Where Table 150.1-A requires a maximum solar heat gain coefficient (SHGC), the requirements shall be met by one of the following:
- A. Complying with the required SHGC pursuant to Section 150.1(c)3A, or
 - B. An exterior operable shading louver or other exterior shading device that meets the required SHGC; or
 - C. A combination of Items A and B to achieve the same performance as achieved in Section 150.1(c)3A.
 - D. For south-facing glazing only, optimal overhangs shall be installed so that the south-facing glazing is fully shaded at solar noon on August 21 and substantially exposed to direct sunlight at solar noon on December 21.
 - E. Exterior shading devices must be permanently secured with attachments or fasteners that are not intended for removal.

Exception to Section 150.1(c)4E: Where the *California Building Code* (CBC) requires emergency egress or where compliance would conflict with health and safety regulations.

- 5. **Reserved.**
- 6. **Heating system type.** Heating system types shall be installed as required in Table 150.1-A.

EXCEPTION to Section 150.1(c)6: A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kW or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.

- 7. **Space heating and space cooling.** All space heating and space cooling equipment shall comply with minimum appliance efficiency regulations as specified in Sections 110.0 through 110.2 and meet all applicable requirements of Sections 150.0 and 150.1(c)7A.

A. **Refrigerant charge.** When refrigerant charge verification or fault indicator display is shown as

required by Table 150.1-A, the system shall comply with either Table 150.1(c)7Ai or 150.1(c)7Aii:

- i. Air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted packaged systems, and mini-split systems, shall comply with Subsections a, b and c, unless the system is of a type that cannot be verified using the specified procedures:

- a. Have measurement access holes (MAH), installed according to the specifications in Reference Residential Appendix Section RA3.2.2.3; and

Exception to Section 150.1(c)7Aia: Systems that cannot conform to the specifications for hole location in Reference Residential Appendix Figure RA3.2-1, shall not be required to provide holes as described in Figure RA3.2-1.

- b. System airflow rate greater than or equal to 350 cfm per ton shall be demonstrated by the installer and be verified by the HERS Rater as specified by Reference Residential Appendix Section RA3. 3 or an approved alternative procedure as specified by Section RA1; and

Exception 1 to Section 150.1(c)7Aib: The Executive Director may approve alternate airflow rate requirements for small duct high velocity systems.

Exception 2 to Section 150.1(c)7Aib: Standard ducted systems without zoning dampers may comply with the minimum airflow rate by meeting the applicable requirements in Table 150.0-B or 150.0-C as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Section RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 150.0(m)12C for the system air filter device(s) shall conform to the requirements given in Tables 150.0-B and 150.0-C.

- c. The installer shall charge the system according to manufacturer’s specifications. Refrigerant charge shall be verified according to one of the following options, as applicable:

Exception 1 to Section 150.1(c)7Aic: When the outdoor temperature is less than 55°F and the installer utilizes the weigh-in charging procedure in Reference Residential Appendix Section RA3.2.3.1 to verify the refrigerant charge, the installer may elect to utilize the HERS Rater verification procedure in Reference Residential Appendix Section RA3.2.3.2. If the HERS Rater verification procedure in Section RA3.2.3.2 is used for compliance, the system's thermostat shall conform to the specifications in Reference Joint Appendix JA5. Ducted systems shall comply with minimum

system airflow rate requirement in Section 150.1(c)7Aib.

- I. The installer and rater shall perform the standard charge procedure as specified by Reference Residential Appendix Section RA3.2.2, or an approved alternative procedure as specified by Section RA1; or
 - II. The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2; or
 - III. The installer shall perform the weigh-in charging procedure as specified by Reference Residential Appendix Section RA3.2.3.1 provided the system is of a type that can be verified using the Section RA3.2.2 standard charge verification procedure and Section RA3.3 airflow rate verification procedure or approved alternatives in Section RA1. The HERS Rater shall verify the charge using Sections RA3.2.2 and RA3.3 or approved alternatives in Section RA1.
- ii. Air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted packaged systems, and mini-split systems, which are of a type that cannot comply with the requirements of Section 150.1(c)7Ai shall comply with Subsections a and b, as applicable.
- I. The installer shall confirm the refrigerant charge using the weigh-in charging procedure specified in Reference Residential Appendix Section RA3.2.3.1, as verified by a HERS Rater according to the procedures specified in Reference Residential Appendix Section RA3.2.3.2.; and
 - II. Systems that utilize forced air ducts shall comply with the minimum system airflow rate requirement in Section 150.1(c)7Aib provided the system is of a type that can be verified using the procedures in Section RA3.3 or an approved alternative procedure in Section RA1.

Exception to Section 150.1(c)7A: Packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify on the Certificate of Installa-

tion that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall comply with minimum system airflow rate requirements in Section 150.1(c)7Aib, provided that the system is of a type that can be verified using the procedure specified in Section RA3.3 or an approved alternative in Section RA1.

8. **Domestic water-heating-systems.** Water-heating-systems shall meet the requirements of either A, B or C. For recirculation distribution systems serving individual dwelling unit, only demand recirculation systems with manual control pumps as specified in the Reference Appendix RA4.4 shall be used:
 - A. For systems serving individual dwelling units, the water heating system shall meet the requirement of either i, ii or iii:
 - i. A single gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank, and that meets the requirements of Sections 110.1 and 110.3 shall be installed.
 - ii. A single gas or propane storage type water heater with an input of 105,000 Btu per hour or less, rated volume less than or equal to 55 gallons and that meets the requirements of Sections 110.1 and 110.3. The dwelling unit shall meet all of the requirements for quality insulation installation (QII) as specified in the Reference Appendix Section RA3.5, and in addition one of the following shall be installed:
 - a. A compact hot water distribution system that is field verified as specified in the Reference Appendix RA4.4.16; or
 - b. All domestic hot water piping shall be insulated and field verified as specified in the Reference Appendix Sections RA4.4.1, RA4.4.3 and RA4.4.14.
 - iii. A single gas or propane storage type water heater with an input of 105,000 Btu per hour or less, rated volume of more than 55 gallons, and that meets the requirements of Sections 110.1 and 110.3, and in addition one of the following shall be installed:
 - a. A compact hot water distribution system that is field verified as specified in the Reference Appendix Section RA4.4.16; or
 - b. All domestic hot water piping shall be insulated and field verified as specified in the Reference Appendix Sections RA4.4.1, RA4.4.3 and RA4.4.14.
 - B. For systems serving multiple dwelling units, a central water heating system that includes the following components shall be installed:
 - i. Gas or propane water heaters, boilers or other water heating equipment that meet the minimum

efficiency requirements of Sections 110.1 and 110.3; and

- ii. A water heating recirculation loop that meets the requirements of Sections 110.3(c)2 and 110.3(c)5 and is equipped with an automatic control system that controls the recirculation pump operation based on measurement of hot water demand and hot water return temperature and has two recirculation loops each serving half of the building; and

Exception to Section 150.1(c)8Cii: Buildings with eight or fewer dwelling units are exempt from the requirement for two recirculation loops.

- iii. A solar water-heating system meeting the installation criteria specified in Reference Residential Appendix Section RA4 and with a minimum solar savings fraction of 0.20 in Climate Zones 1 through 9 or a minimum solar savings fraction of 0.35 in Climate Zones 10 through 16. The solar savings fraction shall be determined using a calculation method approved by the Commission.

9. Space Conditioning Distribution Systems. All space conditioning systems shall meet all applicable requirements of A or B below:

- A. High performance attics. Air handlers or ducts are allowed to be in ventilated attic spaces when the roof and ceiling insulation levels meet Option A or B in Table 150.1-A. Duct insulation levels shall meet the requirements in Table 150.1-A.
- B. Duct and air handlers located in conditioned space. Duct systems and air handlers of HVAC systems shall be located in conditioned space, and confirmed by field verification and diagnostic testing to meet the criterion of Reference Residential Appendix Section RA3.1.4.3.8. Duct insulation levels shall meet the requirements in Table 150.1-A.

Note: Gas heating appliances installed in conditioned spaces must meet the combustion air requirements of the *California Mechanical Code* Chapter 7, as applicable.

10. Central fan integrated ventilation systems. Central forced air system fans used to provide outside air, shall have an air-handling unit fan efficacy less than or equal to 0.58 W/CFM as confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix Section RA3.3. Central fan integrated ventilation systems shall be certified to the Energy Commission as intermittent ventilation systems as specified in Reference Residential Appendix Section RA3.7.4.2.

11. Roofing products. All roofing products shall meet the requirements of Section 110.8 and the applicable requirements of Subsection A or B:

- A. Low-rise residential buildings with steep-sloped roofs in climate zones 10 through 15 shall have a minimum aged solar reflectance of 0.20 and a mini-

um thermal emittance of 0.75, or a minimum SRI of 16.

- B. Low-rise residential buildings with low-sloped roofs, in climate zones 13 and 15 shall have a minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75 or a minimum SRI of 0.75.

Exception 1 to Section 150.1(c)11: Building integrated photovoltaic panels and building integrated solar thermal panels are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.

Exception 2 to Section 150.1(c)11: Roof constructions that have thermal mass over the roof membrane with a weight of at least 25 lb/ft² are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.

12. Ventilation cooling. Single-family homes shall comply with the whole house fan (WHF) requirements shown in Table 150.1-A. When a WHF is required, comply with Subsections A through C below:

- A. Have installed one or more WHFs whose total air flow CFM as listed in the CEC Directory is at least 1.5 CFM/ft² of conditioned floor area; and
- B. Have at least 1 square foot of attic vent free area for each 750 CFM of rated whole house fan airflow CFM, or if the manufacturer has specified a greater free vent area, the manufacturers' free vent area specifications; and
- C. Provide homeowners who have WHFs with a one page "How to operate your whole house fan" informational sheet.

13. HVAC system bypass ducts. Bypass ducts that deliver conditioned supply air directly to the space conditioning system return duct airflow shall not be used.

**TABLE 150.1-A
COMPONENT PACKAGE A-STANDARD BUILDING DESIGN**

			CLIMATE ZONES																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
BUILDING ENVELOPE INSULATION																			
ROOFS/CEILINGS																			
Option A (meets §150.1(c)9A)																			
Continuous insulation above roof rafter	Roofing type	No air space ¹	NR	NR	NR	R-8	NR	NR	NR	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	
		With air space ²	NR	NR	NR	R-6	NR	NR	NR	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6
	Ceiling insulation		R-38	R-38	R-30	R-38	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38
	Radiant barrier		NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
Option B (meets §150.1(c)9A)																			
Below roof deck insulation³	Roofing type	No air space	NR	NR	NR	R-18	NR	NR	NR	R-18	R-18	R-18	R-18	R-18	R-18	R-18	R-18	R-18	
		With air space	NR	NR	NR	R-13	NR	NR	NR	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13
	Ceiling Insulation		R-38	R-38	R-30	R-38	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38
	Radiant Barrier		NR	REQ	REQ	NR	REQ	REQ	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Option C (meets §150.1(c)9B)																			
Ceiling Insulation		R-38	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38	R-38	
Radiant Barrier		NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	
Walls	Above grade	Framed ⁴	U 0.051	U 0.065	U 0.051	U 0.051	U 0.051	U 0.065	U 0.065	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	
		Mass wall interior ⁵	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.059 R-17
		Mass wall exterior ⁶	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0
	Below grade	Below grade interior ⁷	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.070 R-13	U 0.066 R-15
		Below grade exterior ⁸	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.100 R-10	U 0.100 R-10	U 0.053 R-19
	Slab perimeter		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.058 R-7.0
Floors	Raised		U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	
	Concrete raised		U 0.092 R-8.0	U 0.092 R-8.0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.092 R-8.0	U 0.138 R-4.0	U 0.092 R-8.0	U 0.092 R-8.0	U 0.138 R-4.0	U 0.092 R-8.0
BUILDING ENVELOPE																			
ROOFING PRODUCTS																			
Low-sloped	Aged solar reflectance		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.63	NR	0.63	NR	
	Thermal emittance		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR	
Steep-sloped	Aged solar reflectance		NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	NR	
	Thermal emittance		NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	NR	
FENESTRATION																			
Maximum U-factor ⁴			0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	
Maximum SHGC			NR	0.25	NR	0.25	NR	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Maximum total area			20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	
Maximum west facing area			NR	5%	NR	5%	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	

(continued)

**TABLE 150.1-A
COMPONENT PACKAGE A-STANDARD BUILDING DESIGN**

		CLIMATE ZONES															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
HVAC SYSTEM																	
Space heating¹¹	Electric-resistance allowed	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
	If gas, AFUE	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
	If heat pump, HSPF ⁹	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
Space cooling	SEER	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
	Refrigerant charge verification or fault indicator display	NR	REQ	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
	Whole house fan ¹⁰	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
Central system air handlers	Central fan integrated ventilation system fan efficacy	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
Ducts¹²	Roof/ceiling options A & B	Duct insulation	R-8	R-8	R-6	R-8	R-6	R-6	R-6	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8
		§150.1(c)9A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Roof/ceiling option C	Duct insulation	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6
		§150.1(c)9B	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
Water heating	All buildings	System shall meet Section 150.1(c)8															

1. Install the specified *R*-value with no air space present between the roofing and the roof deck.
2. Install the specified *R*-value with an air space present between the roofing and the roof deck. Such as standard installation of concrete or clay tile.
3. *R*-values shown for below roof deck insulation are for wood-frame construction with insulation installed between the framing members.
4. Assembly *U*-factors can be met with cavity insulation alone or with continuous insulation alone, or with both cavity and continuous insulation that results in an assembly *U*-factor equal to or less than the *U*-factor shown. Use Reference Joint Appendices JA4 Table 4.3.1, 4.3.1(a), or Table 4.3.4 to determine alternative insulation products to meet the required maximum *U*-factor.
5. Mass wall has a thermal heat capacity greater than or equal to 7.0 Btu/h-ft². “Interior” denotes insulation installed on the inside surface of the wall.
6. Mass wall has a thermal heat capacity greater than or equal to 7.0 Btu/h-ft². “Exterior” denotes insulation installed on the exterior surface of the wall.
7. Below grade “interior” denotes insulation installed on the inside surface of the wall.
8. Below grade “exterior” denotes insulation installed on the outside surface of the wall.
9. HSPF means “heating seasonal performance factor.”
10. When whole house fans are required (REQ), only those whole house fans that are listed in the Appliance Efficiency Directory may be installed. Compliance requires installation of one or more WHFs whose total airflow CFM is capable of meeting or exceeding a minimum 1.5 cfm/square foot of conditioned floor area as specified by Section 150.1(c)12.
11. A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kilowatts or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.
12. For duct and air handler location: REQ denotes location in conditioned space. When the table indicates ducts and air handlers are in conditioned space, a HERS verification is required as specified by Reference Residential Appendix Section RA3.1.4.3.8.

